

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

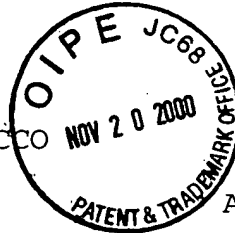
IN THE APPLICATION OF:

APPLICANT : GREGORY M. MAROCCO

SERIAL NO.: 09/135,804

FILED : AUGUST 18, 1998

FOR : CATALYTIC CONVERTER AND RESONATOR COMBINATION



ART UNIT: 1764

EXAMINER: H. TRAN

THE HONORABLE COMMISSIONER OF PATENTS AND TRADEMARKS
WASHINGTON, DC 20231

BRIEF ON APPEAL

Sir:

This is a Brief in support of Applicant's Appeal from the Examiner's decision finally rejecting claims 1-30.

I. REAL PARTY IN INTEREST

Gregory M. Marocco is the real party in interest. This application has not been assigned.

II. RELATED APPEALS AND INTERFERENCES

No related appeals or interferences are known to Appellant.

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LITMAN LAW
OFFICES, LTD.
P.O. BOX 15035
ARLINGTON, VA 22215
(703) 486-1000
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III. STATUS OF CLAIMS

Claims 1-30 are the subject of this appeal. No other claims are pending. An Appendix containing a copy of these appealed claims is attached.

Claims 1, 2, 4, 6, 9, 21, 24-26 and 29 stand finally rejected under 35 U.S.C. § 102(b) as being anticipated by Wagner et al., U.S. Patent No. 5,355,973 (referred hereinafter as "Wagner"). Claims 3, 5, 7, 8, 10-20, 27, 28, and 30 were finally rejected under 35 U.S.C. § 103(a) as being unpatentable over Wagner in view of one or more of the patents to Munro (U.S. Patent No. 4,541,240), Plemons, Jr. (U.S. Patent No. 5,183,976), Ignoffo (U.S. Patent No. 4,032,310), Harris (U.S. Patent No. 5,016,438), Berg et al. (U.S. Patent No. 4,364,761), Lachman et al. (U.S. Patent No. 3,885,977), and/or Japanese patent document no. 64-12017. Claims 1-30 stand further rejected under 35 U.S.C. § 112, first and second paragraphs. The disclosure was objected to because of a minor informality, and the Amendment filed February 15, 2000, was objected to under 35 U.S.C. § 132 as introducing new matter. There are no other rejections or objections of record.

IV. STATUS OF AMENDMENTS

In the Amendment filed February 15, 2000, in response to the initial Office action mailed November 15, 1999, revisions were made to the specification and claims 1, 8, 9, 11, 12, 18, 19, 21, 24,

and 28-30 were amended. The claims, as amended, were again rejected by the Examiner in the Final Rejection of April 18, 2000. It is these claims which are on appeal. (See attached Appendix).

The Amendment After Final Rejection filed on July 18, 2000, was denied entry for the reasons as stated by the Examiner in the Advisory Action of July 26, 2000.

A two month extension of time under 37 CFR 1.136(a), together with a Notice of Appeal and appropriate fees, was filed on September 18, 2000.

V. SUMMARY OF INVENTION

A first embodiment of a device combining a catalytic converter and resonator for a single exhaust system according to the present invention is best depicted in Figures 1-3. Alternative features within the scope of the first embodiment of the present invention include the adjustability feature of the resonator element shown in Figure 2, and the incorporation of dual catalytic converter elements as shown in Figure 3.

A second embodiment of the present invention adapted for a dual exhaust system is depicted in Figures 4 and 5. Alternative features within the scope of this second embodiment include two side by side resonators behind a single catalytic converter as shown in Figure 4, and the two resonators with dual aligned catalytic converters as depicted in Figure 5.

A detailed illustration of the catalytic converter substrate according to the present invention with its relatively thin walls and larger passages is shown in Figure 6, as compared with that of the prior art (Figure 7). A flow chart of the preferred installation arrangements for the catalytic converter/resonator device of the present invention is shown in Figure 8.

The first embodiment of the catalytic converter/resonator device according to the present invention is exemplified in claim 1 which recites a catalytic converter and resonator combination device for use in an exhaust system of an internal combustion engine. The device is adapted for installation between an exhaust manifold and an exhaust tail pipe or an exhaust muffler of an internal combustion engine (Fig. 8). The claimed device comprises a canister 12 (e.g., Fig. 1) including an inlet end 14, a forward portion 16 adjacent the inlet end, a rearward portion 18 adjacent the forward portion, an outlet end 20 adjacent the rearward portion, a forward inner diameter 22, and a rearward inner diameter 26. At least one catalytic converter element 24 having an outer diameter (also designated as 22) and including a substrate 28 having a plurality of longitudinal passages 30 defined by a plurality of substrate walls 32 (Fig. 6) is installed within the forward portion of the canister. These "longitudinal" passages which are the subject of the new matter rejection discussed infra within this Brief is believed to be supported by the originally

filed application at page 16, line 16-19, and by Figures 1-3. A resonator element 34 having a hollow core 36, a forward end 38, a rearward end 40, an outer diameter 42, and a plurality of sound attenuating perforations 46 formed radially therethrough is installed within the rearward portion of the canister. The outer diameter of the resonator element is defined as being smaller than the rearward inner diameter of the canister to define a sound attenuating plenum 44 therebetween. Toroidal plates 48 and 50 not only serve to secure the resonator element concentrically within the rearward portion of the canister, but operate to direct flow of exhaust gases. The elements of the present combination are longitudinally aligned to provide straight through exhaust flow beginning from the inlet end of the canister, through the adjacent catalytic converter element, directly into the resonator element, and exiting the outlet end of the canister. Pages 15-21 of the instant specification provide a detailed description of structure embodied in the claims directed to the first embodiment.

Independent claim 11 is directed to the second embodiment of the invention as supported by pages 31-33 and Figures 3-4. Independent claim 21 is generic to both the first and second embodiments of the present invention. In summary, the second embodiment features the provision for dual exhaust systems, wherein the canister includes a pair of inlets 212 and outlets 214, and contains a pair of catalytic converter elements 222, 224 (Fig. 4).

VI. ISSUES

The issues presented for consideration by the Board of Appeals are as follows:

Issue 1 - Whether claims 1, 2, 4, 6, 9, 21, 24-26 and 29 are anticipated under 35 U.S.C. § 102(b)?

Issue 2 - Whether claims 3, 22 and 23 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Munro?

Issue 3 - Whether claims 5 and 25 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Plemons, Jr.?

Issue 4 - Whether claims 7, 8, 27 and 28 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Berg et al. or Lachman et al.?

Issue 5 - Whether claims 10 and 30 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Ignoffo or Harris?

Issue 6 - Whether claims 11, 12, 14, 16, 19 and 20 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Japanese patent document no. 64-12017 and Harris?

Issue 7 - Whether claim 13 is patentable under 35 U.S.C. § 103(a) over Wagner in view of JP 64-12017 and Harris, and further in view of Munro?

Issue 8 - Whether claim 15 is patentable under 35 U.S.C. § 103(a) over Wagner in view of JP 64-12017 and Harris, and further in view of Plemons, Jr.?

Issue 9 - Whether claims 17 and 18 are patentable under 35 U.S.C. § 103(a) over Wagner in view of JP 64-12017 and Harris, and further in view of Berg et al. or Lachman et al.?

Issue 10 - Whether the specification provides support for the invention as is now claimed under 35 U.S.C. § 112, first paragraph?

Issue 11 - Whether claims 1-30 are definite under 35 U.S.C. § 112, second paragraph?

Issue 12 - Whether the Amendment filed February 15, 2000 introduced new matter into the disclosure (35 U.S.C. 132)?

Issue 13 - Other informality considerations.

VII. GROUPING OF CLAIMS

For each ground of rejection which Appellant contests herein which applies to more than one claim, such additional claims, to the extent separately identified and argued below do not stand or fall together.

VIII. ARGUMENT

Issue 1 - Whether claims 1, 2, 4, 6, 9, 21, 24-26 and 29 are anticipated under 35 U.S.C. § 102(b)?

Each of independent claims 1 and 21 recite a catalytic converter and resonator combination device and functionally recite that the device is adapted to be installed "between an exhaust manifold and an exhaust tail pipe or an exhaust muffler." In other

word, the claimed device may be used in conjunction with or without a "muffler" in the exhaust system of an internal combustion engine. Claims 1 and 21 further set forth an arrangement of the catalytic converter and resonator elements such as to provide straight through flow of engine exhaust beginning from the inlet end of the canister, through the adjacent catalytic converter element, directly into the resonator element, prior to exiting the outlet end of the canister.

In contrast, Wagner teaches a muffler with a catalytic converter arrangement specifically adapted for use with diesel internal combustion engines. Generally speaking, resonators are not mufflers, in that they do not serve to attenuate or cancel a broad range of exhaust frequencies, but rather reduce or eliminate certain objectionable sound frequencies which are more difficult to attenuate using a conventional muffler. In any event, Wagner teaches a muffler arrangement that is structurally and functionally distinguishable from the sound attenuation element of the appealed claims. In this regard, Wagner specifically teaches the use of "resonating chambers" positioned upstream of region 6 to facilitate sound control. In the downstream acoustical segment 7, Wagner discloses the use of a sonic choke arrangement in association with resonating chambers to achieve sound attenuation. These resonating chambers allow for the expansion of the exhaust gases and engine noises to enter, forming pressurized "dead-spaces" that demonstrate

the physical phenomenon of harmonic cancellation to attenuate engine noises. This phenomenon occurs by virtue of the pressurized dead-spaces reflecting trapped noises back onto the subsequent engine exhaust gases and noises. In diesel engines this back pressure enhances engine performance by the virtue of the operation of the diesel engine, but would prove to be unsuitable in a standard gasoline engine. In addition, the dead-spaces of Wagner do not allow the exhaust gases to exit the device until the engine has been shut down, removing the source of incoming pressure. Upon the removal of the incoming pressure, the back pressure of the dead-space gases pass back through the resonators in order to escape into the atmosphere. Depending upon the diesel engine fuel by-products found in the exhaust gases, once the incoming pressure is removed the trapped gases could ignite causing the undesirable "back-fire". Although Wagner alludes to the use of his muffler arrangement with gasoline internal combustion engines, this reference is silent as to how such a modification may be accomplished.

The structure of the present claimed invention as well as the attendant advantages achieved with the claimed structure as demonstrated by the test results reported under the instant specification are neither taught nor suggested by Wagner. Appellant contents that Wagner is deficient as an anticipatory reference since it fails to disclose each structural element and

its arrangement as set forth in independent claims 1 and 21. In is not enough that the reference disclose all the claimed elements in isolation. Rather, as stated by the Federal Circuit, the prior art reference must disclose each element "arranged as in the claims." Lindermann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481 (Fed. Cir. 1984) (emphasis added).

Issue 2 - Whether claims 3, 22 and 23 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Munro?

The Wagner reference has been discussed extensively under Issue 1 and is not believed to be combinable with the teachings of the Munro patent, which is directed an exhaust system for internal combustion engines. Assuming argument that the references are properly combinable, the resulting combination would not teach or suggest the catalytic converter/resonator arrangement such as presently claimed.

Issue 3 - Whether claims 5 and 25 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Plemons, Jr.?

These claims are patentable over the combined references in view of the shortcomings of Wagner as discussed above. Further, the Plemons, Jr. reference is concerned with a free flowing device capable of sound attenuation which doesn't contribute to increased back pressure, whereas Wagner's muffler arrangement is designed to restrict the flow of exhaust gas in order to not only reduce the

noise level, but to provide the appropriate back pressure necessary for the efficient performance of a diesel engine. Thus, the Wagner reference is not believed to be combinable with the teachings of the Plemons, Jr. patent. Even if the references are combinable, the resulting combination would not teach or suggest the presently claimed catalytic converter/resonator arrangement.

Issue 4 - Whether claims 7, 8, 27 and 28 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Berg et al. or Lachman et al.?

In this rejection, Berg et al. and Lachman et al. were relied upon as disclosing the ceramic substrates having passages of the width specified by the dependent claims. The combination of references would at best result in the substitution of the porous ceramic core of Wagner for the particular ceramic substrate of Berg et al. or Lachman et al. The resulting modification would not result in the presently claimed invention for the reasons advanced above.

Issue 5 - Whether claims 10 and 30 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Ignoffo or Harris?

In this rejection, Ignoffo and Harris were relied upon by the Examiner to show the conventionality of providing multiple catalytic converter elements. It should be noted that Wagner teaches that diesel engines such as truck engines have very limited

space for the placement of a single catalytic converter, and that it is desirable for the converter element of his muffler assembly to occupy as small a space as possible. Thus, one skilled in the art would not be persuaded in light of the teachings afforded by Wagner to modify the reference muffler assembly by incorporating therein an arrangement of plural catalytic converter elements as suggested by the Examiner. Claims 10 and 30 are further considered allowable for the above reasons differentiating these claimed invention over Wagner.

Issue 6 - Whether claims 11, 12, 14 16, 19 and 20 are patentable under 35 U.S.C. § 103(a) over Wagner in view of Japanese patent document no. 64-12017 and Harris?

Independent claim 11 is considered allowable over the references applied in this rejection for the same reasons discussed under Issues 1 and 5. Inter alia, none of these references, taken either singly or in the proposed combination, disclose, teach or reasonably suggest a pair of catalytic converter elements for dual exhaust systems having the arrangement specified in claim 11.

Corresponding dependent claims 12, 14 16, 19 and 20 are also considered allowable for the reasons discussed above.

Issue 7 - Whether claim 13 is patentable under 35 U.S.C. § 103(a) over Wagner in view of JP 64-12017 and Harris, and further in view of Munro?

Issue 8 - Whether claim 15 is patentable under 35 U.S.C. § 103(a) over Wagner in view of JP 64-12017 and Harris, and further in view of Plemons, Jr.?

Issue 9 - Whether claims 17 and 18 are patentable under 35 U.S.C. § 103(a) over Wagner in view of JP 64-12017 and Harris, and further in view of Berg et al. or Lachman et al.?

Claims 13, 15, 17 and 18 are consider patentable over the above-mentioned references applied in their respective rejections for the reasons advanced above in connection with the discussions pertaining to Munro, Plemons, Jr., Berg et al. and Lachman et al. The combination of references to Wagner, JP 64-12017 and Harris would not result in a device including a pair of catalytic converter elements for dual exhaust systems having the arrangement specified in claim 11. The only guidance or suggestion to construct Applicant's presently claimed invention is provided by Applicant's own disclosure, which cannot appropriately be used as a blueprint to meet the instant claims. Uniroyal Inc. v. Rudkin-Wiley Corp., 5 USPQ2d 1434. It is impermissible hindsight to use the claims as a frame and the prior art references as a mosaic to piece together a facsimile of the invention. W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 312 (Fed. Cir. 1983).

Issue 10 - Whether the specification provides support for the invention as is now claimed under 35 U.S.C. § 112, first paragraph?

This rejection is traversed since the disclosure clearly supports the structure embraced by the amendatory language. Figures 1-3 show a cylindrical canister in which the -longitudinal axis- extends substantially along the illustrated "exhaust gas arrows G". Reference is also made to page 20, line 11, which recites "the axis of the resonator". As mentioned above, the catalytic converter element is described at page 16, lines 16-19, of the original specification as including "a substrate 28 having a plurality of longitudinal passages 30 therethrough". Clearly, one of ordinary skill in the art, reviewing the disclosure as originally filed, would readily ascertain that the canister inherently includes a longitudinal axis and that the "longitudinal passages" in question are oriented in a direction parallel with the axis of the canister. Indeed, the original disclosure provides clear support for the added claim limitations considered by the Examiner to be "nowhere disclosed in the original disclosure".

Issue 11 - Whether claims 1-30 are definite under 35 U.S.C. § 112, second paragraph?

With regard to claim 1, the Examiner states in the Final Rejection that "it is unclear as to the newly added limitations are disclosed in the original specification. This rejection is

traversed for the reasons as stated above. Regarding the Examiner's criticisms of claims 7 and 11, the unentered Amendment After Final filed July 18, 2000, is believed to address and overcome the rejection under 35 USC 112, second paragraph. See Applicant's remarks as set forth on page 8 of this amendment.

Issue 12 - Whether the Amendment filed February 15, 2000 introduced new matter into the disclosure (35 U.S.C. 132)?

Applicant proposed in the unentered Amendment After Final to resolve this issue by deleting the amendatory subject matter at pages 11 and 17. Since this new matter objection does not effect the issues on appeal, Appellant intends to resolve this issue following this Appeal.

Issue 13 - Other informality considerations.

The Examiner noted an informality on page 21, line 22, which was addressed by Applicant in the unentered Amendment After Final. Appellant intends to resolve this issue following this Appeal.

CONCLUSION

For the foregoing reasons, Appellant respectfully contends that each claim is patentable. Therefore, reversal of all rejections is courteously solicited.

Serial No.: 09/135,804
Art Unit: 1764

The fee for filing the Brief in support of the Appeal is attached. Please charge any additional fees due in connection with the filing of this paper to Deposit Account No. 12-1662 of the undersigned.

Respectfully submitted,



Richard C. Litman
Registration No. 30,868
LITMAN LAW OFFICES, LTD.
P.O. Box 15035
Arlington, VA 22215
(703) 486-1000

RCL:DHT

APPENDIX

APPEALED CLAIMS

1. (Amended) A catalytic converter and resonator combination device for use in an exhaust system of an internal combustion engine, whereby said device being disposed between an exhaust manifold and an exhaust tail pipe or an exhaust muffler, said device comprising:

a canister for installing in the exhaust system of the internal combustion engine, said canister having a longitudinal axis, and including an inlet end, a forward portion adjacent said inlet end, a rearward portion adjacent said forward portion, an outlet end adjacent said rearward portion, a forward inner diameter, and a rearward inner diameter;

at least one catalytic converter element installed within said forward portion of said canister, with said catalytic converter element having an outer diameter and including a substrate having a plurality of longitudinal passages therethrough, with each of said passages being defined by a plurality of substrate walls, said passages being parallel with the longitudinal axis of said canister;

a resonator element installed within said rearward portion of said canister, with said resonator element having a hollow core, a forward end, a rearward end, an outer diameter, and a plurality of sound attenuating perforations formed radially therethrough;

said outer diameter of said resonator element being smaller than said rearward inner diameter of said canister, and defining a sound attenuating plenum therebetween; and

25 said inlet end of said canister, said catalytic converter
26 element, said hollow core of said resonator element, and said
27 outlet end of said canister all being aligned along said
28 longitudinal axis with one another for providing straight through
29 flow of engine exhaust therethrough.

2. The catalytic converter and resonator combination according to
claim 1 wherein said canister comprises a monolithic tubular shell.

3. The catalytic converter and resonator combination according to
claim 1, wherein at least said canister and said resonator element
are formed of corrosion resistant steel.

4. The catalytic converter and resonator combination according to
claim 1, including a toroidal forward plate and a toroidal rearward
plate affixed respectively to said forward end and said rearward
end of said resonator element and normal thereto, for spacing said
resonator element concentrically within and attaching said
resonator element to said canister.

5. The catalytic converter and resonator combination according to
claim 4, wherein said forward plate has a solid periphery devoid of
passages therethrough for precluding exhaust gas flow therethrough,
and said rearward plate includes a plurality of generally
peripheral passages therethrough.

6. The catalytic converter and resonator combination according to claim 1, wherein said outer diameter of said catalytic converter element and said forward inner diameter of said canister are substantially equal, with said catalytic converter element being tightly fitted within said canister for precluding exhaust gas flow therebetween.

7. The catalytic converter and resonator combination according to claim 1, wherein each of said passages of said substrate has a width substantially greater than .040 inch, for reducing the restriction of exhaust gas flow therethrough.

8. (Amended) The catalytic converter and resonator combination according to claim 1, wherein said substrate walls of said at least one catalytic converter element provide a surface area to substrate volume ratio for accelerating heat transfer to said substrate walls, for correspondingly accelerating the catalytic reaction within said catalytic converter element.

9. (Amended) The catalytic converter and resonator combination according to claim 1, wherein said substrate of said at least one catalytic converter element is formed of material selected from the group consisting of ceramics and cordierite ceramics.

10. The catalytic converter and resonator combination according to claim 1, wherein said at least one catalytic converter element comprises a plurality of catalytic converter elements axially and concentrically disposed within said forward portion of said canister, said catalytic converter elements being spaced apart from one another to define at least one catalytic converter plenum therebetween and further being spaced apart from said forward end of said resonator element to define an intermediate plenum therebetween.

1 11. (Amended) A catalytic converter and resonator combination
2 device for use in an exhaust system of an internal combustion
3 engine, whereby said device being disposed between an exhaust
4 manifold and an exhaust tail pipe or an exhaust muffler, said
5 device comprising:

6 a canister for installing in the exhaust system of the
7 internal combustion engine, said canister having a longitudinal
8 axis, and including a pair of inlets, a forward portion adjacent
9 said inlets, a rearward portion adjacent said forward portion, a
10 pair of outlets adjacent said rearward portion, a forward inner
11 circumference, and a rearward inner diameter;

12 at least one catalytic converter element installed within said
13 forward portion of said canister, with said catalytic converter
14 element having an outer circumference and including a substrate
15 having a plurality of longitudinal passages therethrough, with each
16 of said passages being defined by a plurality of substrate walls,

17 said passages being parallel with the longitudinal axis of said
18 canister;

19 a first and a second resonator element installed within said
20 rearward portion of said canister, with each said resonator element
21 having a hollow core, a forward end, a rearward end, an outer
22 diameter, and a plurality of sound attenuating perforations
23 therethrough, with each said resonator element being disposed
24 alongside one another;

25 said outer diameter of each said resonator element being
26 smaller than said rearward inner diameter of said canister, and
27 defining a sound attenuating plenum therebetween; and

28 said inlets of said canister, said catalytic converter
29 element, said hollow core of each said resonator element, and said
30 outlets of said canister all being axially parallel to one another
31 and said longitudinal axis for providing straight through flow of
32 engine exhaust therethrough.

12. (*Amended*) The catalytic converter and resonator combination according to claim 11, wherein said canister comprises a monolithic tubular shell.

13. The catalytic converter and resonator combination according to claim 11, wherein at least said canister and each said resonator element are formed of corrosion resistant steel.

14. The catalytic converter and resonator combination according to claim 11, including a forward plate and a rearward plate, with each said plate having a pair of spaced apart resonator core passages therethrough and being affixed respectively to said forward end and said rearward end of each said resonator element and normal thereto, for spacing each said resonator element within and attaching each said resonator element to said canister.

15. The catalytic converter and resonator combination according to claim 14, wherein at least said rearward plate includes a plurality of generally peripheral passages therethrough.

16. The catalytic converter and resonator combination according to claim 11, wherein said outer circumference of said catalytic converter element and said forward inner circumference of said canister are substantially equal, with said catalytic converter element being sealed to said canister for precluding exhaust gas flow therebetween.

17. The catalytic converter and resonator combination according to claim 11, wherein each of said passages of said substrate has a width substantially greater than .040 inch, for reducing the restriction of exhaust gas flow therethrough.

18. (Amended) The catalytic converter and resonator combination according to claim 11, wherein said substrate walls of said at least one catalytic converter element provide a surface area to substrate volume ratio for accelerating heat transfer to said substrate walls, for correspondingly accelerating the catalytic reaction within said catalytic converter element.

19. (Amended) The catalytic converter and resonator combination according to claim 11, wherein said substrate of said at least one catalytic converter element is formed of material selected from the group consisting of ceramics and cordierite ceramics.

20. The catalytic converter and resonator combination according to claim 11, wherein said at least one catalytic converter element comprises a plurality of catalytic converter elements axially and concentrically disposed within said forward portion of said canister, said catalytic converter elements being spaced apart from one another to define at least one catalytic converter plenum therebetween and further being spaced apart from said forward end of said resonator element to define an intermediate plenum therebetween.

21. (Amended) A catalytic converter and resonator combination device for use in an exhaust system of an internal combustion engine, whereby said device being disposed between an exhaust manifold and an exhaust tail pipe or an exhaust muffler, said device comprising:

a canister for installing in the exhaust system of the internal combustion engine, said canister having a longitudinal axis, and including at least one inlet, a forward portion adjacent said at least one inlet, a rearward portion adjacent said forward portion, at least one outlet adjacent said rearward portion, a forward inner circumference, and a rearward inner diameter;

at least one catalytic converter element installed within said forward portion of said canister, with said catalytic converter element having an outer circumference and including a substrate having a plurality of longitudinal passages therethrough, with each of said passages being defined by a plurality of substrate walls, said passages being parallel with the longitudinal axis of said canister;

at least one resonator element installed within said rearward portion of said canister, with said at least one resonator element having a hollow core, a forward portion, a rearward portion, an outer diameter, and a plurality of sound attenuating perforations formed radially through said forward portion thereof, with said rearward portion thereof being devoid of perforations therethrough;

said outer diameter of said at least one resonator element being smaller than said rearward inner diameter of said canister,

27 and defining a sound attenuating plenum therebetween;
28 said at least one inlet of said canister, said at least one
29 catalytic converter element, said hollow core of said at least one
30 resonator element, and said at least one outlet end of said
31 canister all being aligned along said longitudinal axis with one
32 another for providing straight through flow of engine exhaust
33 therethrough;
34 said rearward portion of said at least one resonator element
35 extending outwardly beyond said at least one outlet of said
36 canister; and
37 said at least one resonator element being selectively axially
38 positionable within said canister for selectively attenuating
39 exhaust sound frequencies in a predetermined sound frequency range.

22. The catalytic converter and resonator combination according to claim 21 wherein said canister comprises a monolithic tubular shell, with said sound attenuating plenum including sound absorbent material disposed therein.

23. The catalytic converter and resonator combination according to claim 21, wherein at least said canister and said at least one resonator element are formed of corrosion resistant steel.

24. (Amended) The catalytic converter and resonator combination according to claim 21, including a forward plate affixed to said forward portion of said at least one resonator element and normal thereto, for spacing said at least one resonator element within and attaching said at least one resonator element to said canister.

25. The catalytic converter and resonator combination according to claim 24, wherein said forward plate has a solid periphery devoid of passages therethrough for precluding exhaust gas flow therethrough.

26. The catalytic converter and resonator combination according to claim 21, wherein said outer circumference of said catalytic converter element and said forward inner circumference of said canister are substantially equal, with said catalytic converter element being tightly fitted within said canister for precluding exhaust gas flow therebetween.

27. The catalytic converter and resonator combination according to claim 21, wherein each of said passages of said substrate has a width substantially greater than .040 inch, for reducing the restriction of exhaust gas flow therethrough.

28. (Amended) The catalytic converter and resonator combination according to claim 21, wherein said substrate walls of said at least one catalytic converter element provide a surface area to substrate volume ratio for accelerating heat transfer to said substrate walls, for correspondingly accelerating the catalytic reaction within said catalytic converter element.

29. (Amended) The catalytic converter and resonator combination according to claim 21, wherein said substrate of said at least one catalytic converter element is formed of material selected from the group consisting of ceramics and cordierite ceramics.

30. (Amended) The catalytic converter and resonator combination according to claim 21, wherein said at least one catalytic converter element comprises a plurality of catalytic converter elements axially and concentrically disposed within said forward portion of said canister, said catalytic converter elements being spaced apart from one another to define at least one catalytic converter plenum therebetween and further being spaced apart from said forward portion of said at least one resonator element to define an intermediate plenum therebetween.